(12) UK Patent Application (19) GB (11) 2 159 255 A

(43) Application published 27 Nov 1985

(21) Application No 8411535

(22) Date of filing 4 May 1984

(71) Applicant
Pilkington P E Limited (United Kingdom),
Prescot Road, St Helens, Merseyside WA10 3TT

(72) Inventor
Philip John Rogers

(74) Agent and/or Address for Service
R A Bride,
Pilkington Brothers P L C, Group Patents Department,
Prescot Road, St Helens, Merseyside WA10 3TT

(51) INT CL[4]
F41G 3/26 F41F 27/00

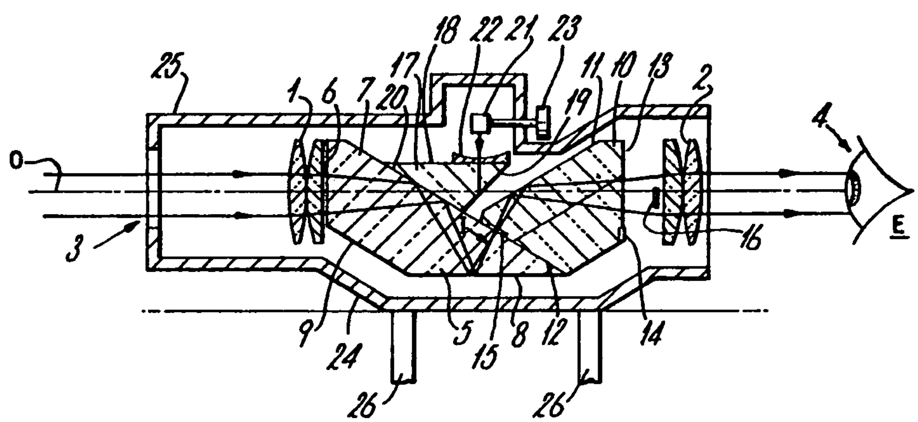
(52) Domestic classification
F3C TE

(56) Documents cited
None

(58) Field of search
F3C

(54) Sighting apparatus

(57) Sighting apparatus for use in a mock battle situation which can be simply attached to a firearm, such as a rifle, without the need for accurate alignment with the bore or real sights comprises a unity magnification telescope with an objective lens and an eyepiece lens, a prism assembly with a foresight representation at an interface, and a backsight representation 16 at or near the eyepiece lens, arranged so that backsight and foresight and realworld images appear at distances consistent with those of the real firearm. Firing is simulated by injecting a beam from a radiation, eg. infrared laser source 21 into the prism assembly for emission through the objective lens.

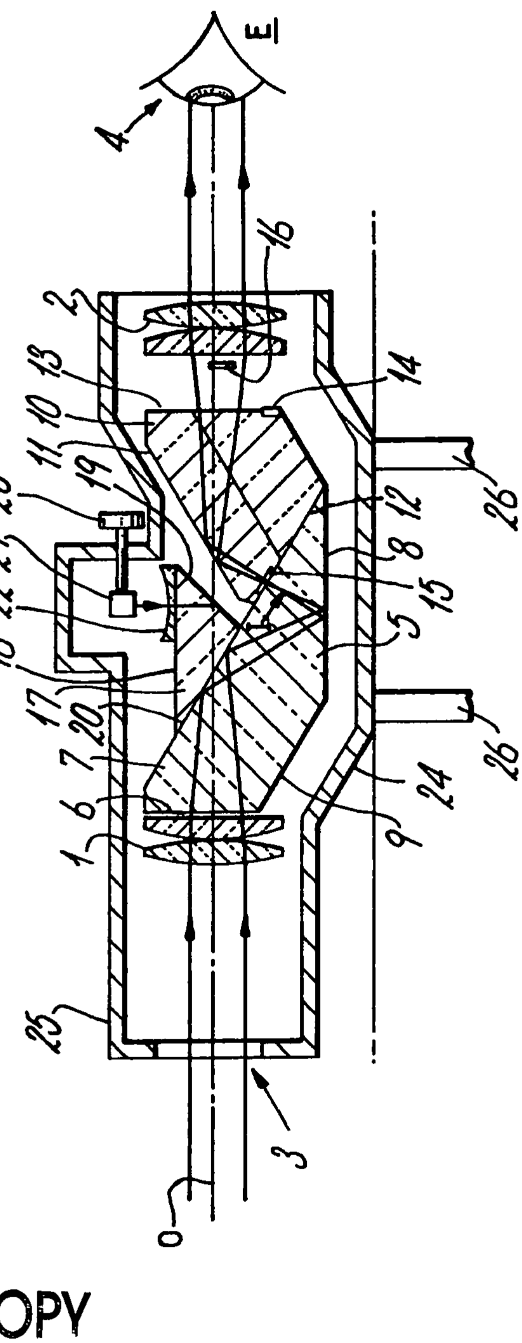


GB 2 159 255 A

The drawing originally filed was informal and the print here reproduced is taken from a later filed formal copy.
The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.

2159255

1/1



BEST AVAILABLE COPY

SPECIFICATION

Improvements in or relating to sighting apparatus

This invention concerns improvements in or relating to sighting apparatus.

In simulated battle conditions it is sometimes the practice to fire laser beams instead of live ammunition. This can add to the realism by enabling a mock combatant to take aim and shoot at an 'enemy' person, who can be provided with means for detecting a hit by the laser beam. However, ensuring that the fired laser beam is properly aligned with the sights of the rifle, or other firearm, with which it is used can be a complex and difficult procedure.

According to the present invention there is provided a sighting apparatus comprising a unity magnification telescope having objective and eyepiece lenses between which an intermediate image is formed, a prism assembly disposed between the objective and eyepiece lenses and comprising a first prism and a roof-edged second prism which interfaces with the first prism, a foresight representation at the interface between the first and second prisms, a backsight representation at or near the eyepiece lens, and means for injecting a radiation beam into the prism assembly for emission through the objective lens, the arrangement being such that an observer looking through the apparatus can view backsight and foresight and realworld images at respective distances substantially consistent with those at which real sights of a firearm and the realworld appear when aiming the firearm, and said radiation beam can be fired at a realworld target sighted by such images. Such sighting apparatus can be simply attached to a firearm, such as a rifle, for use in a mock battle situation without the need for accurately aligning the sighting apparatus with the firearm's bore or real sights. The sighting apparatus effectively provides its own sighting axis with which the fired radiation beam can be aligned, and the precise relationship of the sighting apparatus sighting and firing axis to the firearm's real sighting and firing axis is of no consequence.

The injected radiation beam is preferably a laser beam and may be of infra-red radiation. Said means to inject the beam may comprise a narrow waveband radiation source, such as a laser diode, and there may be provided means, such as a negative lens element, to reduce the radiation beam divergence, which may for example be connected to a face of the prism assembly.

The prism assembly may comprise a third prism into which the radiation beam is injected and which interfaces with said first prism. A wavelength selective filter, for example in the form of a coating, may be provided at the interface between the first and third prisms to effect selective transmission of the radiation beam waveband but reflection of other wavelengths from the realworld. Said first prism may have a long face, part of which interfaces with said second prism and part of which interfaces with said third prism.

Adjustment means are preferably provided for adjusting the radiation beam emission relative to the sighting axis, and conveniently these may comprise means to adjust the radiation source position along orthogonal directions.

The unity magnification telescope is preferably of substantially symmetrical form with substantially identical objective and eyepiece lenses, each of which may for example have two lens elements. Preferably the apparatus includes a hood effectively defining an entrance pupil through which realworld light can pass to the objective lens, and the prism assembly may have anti-ghosting provisions such as one or more cut-backs or chamfers or baffles.

An embodiment of sighting apparatus in accordance with the invention will now be described, by way of example, with reference to the accompanying drawing, which is a schematic representation.

The apparatus comprises a basically symmetrical unity (i.e. X1) magnification telescope which produces an erect image. The telescope has a two element objective lens 1 and an identical two element eyepiece lens 2 disposed along an optical axis O. An intermediate image I is formed between the objective and eyepiece lenses and the telescope has an entrance pupil 3 and an exit pupil 4 at which an observer's eye E can be located.

Between the objective and eyepiece lenses is disposed a prism assembly comprising a first prism 5 having an entrance face 6 adjacent the objective lens 1 and orthogonal to the axis O, a long face 7 inclined to the axis O, and a bottom face 7 inclined to the axis O, and a bottom face 8 parallel to the axis O. The prism corner between the faces 6 and 8 is cut-back or chamferred at 9 for anti-ghosting purposes. A second prism 10, having a roof-edge 11 inclined to the axis O, has its input face 12 connected to an exit end portion of the long face 7 of the first prism 5. The second prism 10 has an output face 13 orthogonal to the axis O adjacent the eyepiece lens 2, and an anti-ghosting baffle 14 is provided at the bottom of the output face 13.

An opaque, preferably black, graticule 15 providing a representation of a foresight is located at the interface between the prisms 5 and 10, i.e. is effectively sandwiched between the exit part of the long face 7 and the input face 12. This foresight 15 is imaged at a distance, e.g. about half a metre, in front of the observer consistent with the position of a real foresight on a rifle. An opaque, preferably

black, backsight representation 16 is located at (e.g. adhered to or coated on) or near (by a suitable mounting) the front face of the eyepiece lens 2 so that this backsight 16 appears at a distance, e.g. about 50 mm, in front of the observer consistent with the position of a real backsight on a rifle.

The embodiment as described so far operates in use in the following manner. Realworld light passing through the entrance pupil 3 and transmitted through the objective lens 1 enters the prism 5 through the face 6, is internally reflected at the faces 7 and 8, and forms the intermediate image I at a position in front of the interface with the prism 10. This image I is thus spaced from the foresight 15 so that the realworld image appears to the observer at a distance from the foresight image in the same way as the realworld appears at a distance from the real foresight on a rifle. The actual distance at which the realworld image appears corresponds to the distance of the realworld scene or object under view, which will generally be relatively distant, e.g. a hundred metres or so. However, the image need not necessarily appear at the same position as the object, but may be nearer to help field curvature. Light from the intermediate image I enters prism 10 through input face 12, is internally reflected at the faces forming the roof-edge 11, and then emerges through the output face 13. It will be understood that the roof-edge reflection effects a lateral inversion (left to right and right to left) so that the erect realworld image presented to the observer is also laterally correct. Light from the output face 13 is transmitted through the eyepiece lens 2 to the exit pupil 4. An observer viewing at this exit pupil can thus see at their respective distances the backsight and foresight and realword images and can lay the sighting axis 0 onto, i.e. aim at, a realworld target by aligning the backsight 16 and foresight 15 with the view of that target in the same way as the real back and foresights of a rifle are aligned with the target when aiming.

The prism assembly further comprises a third prism 17 having an inlet face 18 parallel to the axis 0, an inclined face 19, and an outlet face 20 which is cemented to part of the long face 7 of the prism 5. A beam of infra-red radiation from a gallium arsenide laser diode 21 is injected into the prism 17 through a negative lens element 22 cemented to the inlet face 18. The lens element 22 serves to reduce the initial divergence of the laser beam which is internally reflected at the face 19 of the prism 17 and is then transmitted through the outlet face 2 to enter the prism 5 at that interface. It emerges from the prism 5 through the face 6 and is then transmitted through the objective lens 1 to travel as a narrow collimated output beam along the axis 0. The face 19 of the prism 17 is coated to be internally reflecting to the laser radiation, and a wavelength selective filter is provided at the interface between the prisms 17 and 5, conveniently by a suitable dichroic coating on the outlet face 20, to transmit the laser radiation but to reflect other wavelengths from the realworld. Adjustment means 23 are provided for moving the laser diode 21 in two orthogonal (X-Y) directions so as to adjust its postion to locate the output laser beam on the axis 0, i.e. to bring the sighting and firing axes into coincidence.

The lenses 1, 2 and 22 and prisms 5, 10 and 17 are preferably made of optical glass and are contained in a suitable metal housing 24 which also provides a hood 25 effectively defining the entrance pupil 3. The housing has attachment means 26, for example straps, by which the apparatus can readily be attached to or detached from a rifle. The manner of attachment can be quite simple since there is no need for an accurate alignment of the sighting apparatus axis with the real sighting axis or the bore of the rifle. The apparatus provides its own sighting and firing axis and the exact relationship to the rifle's real sighting and firing axis is irrelevant. It is sufficient if the sighting apparatus is mounted on the rifle in a manner which gives the user a realistic impression of aiming the rifle. In use, the laser diode 21 is operatively connected to the rifle's trigger so that squeezing the trigger fires the laser. If the apparatus is properly sighted, then the output laser beam will hit the target.

It will be seen that apparatus as described above provides a simulator for mock battle use which can be sturdy and compact with simple optical components. It will be appreciated that the particular embodiment shown and described, whilst a preferred arrangement, is given by way of illustration and example and that other forms might be employed. Notably, different forms of prism assembly may be designed to serve the same purpose. In some circumstances the anti-ghosting provisions may be considered unnecessary or may be modified (e.g. the cut-back 9 on the prism 5 might be replaced by a baffle and/or the baffle 14 might be replaced by a cut-back). Although symmetry is generally preferable, the telescope need not necessarily be of symmetrcal form. The objective and eyepiece lenses could be of a different form from the simple two element version shown. The injected radiation, although preferably invisible need not necessarily be infra-red and other wavelengths (including visible if acceptable in the circumstances of use) could be employed, the radiation source being chosen accordingly. Also, although especially suitable for attachment to a rifle, the apparatus could be attached to other forms of firearm, and may be adapted if necessary for such attachment.

CLAIMS

1. Sighting apparatus comprising a unity magnification telescope having objective and eyepiece lenses between which an intermediate image is formed, a prism assembly disposed between the objective and eyepiece lenses and comprising a first prism and a roof-edged second prism which interfaces with the first prism, a foresight representation at the interface between the first and second prisms, a backsight representaton at or near the eyepiece lens, and means for injecting a radiation beam into the prism assembly for emission through the objective lens, the arrangement being such that an observer looking through the apparatus can view backsight and foresight and realworld images at respective distances substantially consistent with those at which real sights of a firearm and the realworld appear when aiming the firearm, and said radiation beam can be fired at a realworld target sighted by such images.

2. Apparatus according to Claim 1 in which the injected radiation beam is a laser beam.

3. Apparatus according to Claim 1 or Claim 2 in which the injected radiation beam is of infra-red radiation.

4. Apparatus according to any preceding claim in which said means for injecting the radiation beam comprise a narrow waveband radiation source.

5. Apparatus according to Claim 4 in which said source is a laser diode.

6. Apparatus according to any preceding claim comprising means to reduce the radiation beam divergence.

7. Apparatus according to Claim 6 in which said means to reduce the radiation beam divergence comprises a negative lens element.

8. Apparatus according to Claim 6 or Claim 7 in which said means to reduce the radiation beam divergence is connected to a face of the prism assembly.

9. Apparatus according to any preceding claim in which the prism assembly comprises a third prism into which the radiation beam is injected and which interfaces with said first prism.

10. Apparatus according to Claim 9 comprising a wavelength selective filter at the interface between the first and third prisms to effect selective transmission of the radiation beam waveband but reflection of other wavelengths from the realworld.

11. Apparatus according to Claim 10 in which said wavelength selective filter is in the form of a coating.

12. Apparatus according to any of Claims 9 to 11 in which said first prism has a long face part of which interfaces with said second prism and part of which interfaces with said third prism.

13. Apparatus according to any preceding claim comprising adjustment means for adjusting the radiation beam emission relative to the sighting axis.

14. Apparatus according to Claim 13 in which the adjustment means comprise means to adjust the radiation beam source position along orthogonal directions.

15. Apparatus according to any preceding claim in which the unity magnification telescope is of substantially symmetrical form with substantially identical objective and eyepiece lenses.

16. Apparatus according to any preceding claim in which the objective and eyepiece lenses each have two lens elements.

17. Apparatus according to any preceding claim including a hood effectively defining an entrance pupil through which realworld light can pass to the objective lens.

18. Apparatus according to any preceding claim in which the prism assembly has anti-ghosting provisions.

19. Apparatus according to Claim 18 in which the anti-ghosting provisions comprise one or more cut-backs or chamfers or baffles.

20. Sighting apparatus substantially as described herein with reference to the accompanying drawing.

Printed in the United Kingdom for Her Majesty's Stationery Office, Dd 8818935, 1985, 4235. Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.